Distribution, accumulation of Selenium-75 by time in different organs and tissues of Scardinus erythrophtalmus (Linné)

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Because of the importance of selenium in the metabolism of living organisms and its role in environmental pollution (1-5),a study on Scardinus erythrophthalmus (LINNE) which is important food was carried out by injecting 0.050 cc (0.34 µCi/g) of sodium salt of selenium-75 isotope into the abdomen muscle of the fishes. 11 fishes were dissected after 2 days and 3 fishes each after 4, 6,8,10,12 and 14 days. The radioactivity was measured on an Ecko N 530 G type scintillation detector with NaI (TI) crystal of 2x2 inch. The radioactivity was measured in one gram of the tissues and organs and reported as per mille of dose injected.

For all periods the tissues and organs of the fishes can be classified into three main groups according to the retention of selenium-75. The first group: liver, spleen, kidney, stomach, small and large intestine and gall bladder retained the highest amounts of selenium-75.The second group: fins,heart, gill, blood, air bladder, scale, skin, head, gonad, brain and fat tissue retained medium levels,The third group: chest muscle, tail muscle and dorsal muscle retained the lowest amounts of selenium-75.

Also the same organs and tissues did not give the same value by the time.

Some organs of the same structure and function,for example ventral and anal fins present relatively different behaviors with respect to the retention of selenium-75.

The selenium-75 concentrations determined during long periods after injection in tissues and organs of Carassius auratus gibelio (BLOCH) (6) and the results of the other investigations carried out on calves, lambs, pigs (7), rats (8) and human beings (9) support our findins relating the distributions of selenium - 75.

In our study, the digestive system, liver, spleen,kidney and gall bladder retained the highest amounts of selenium-75. These organs are not used as human food. Since the muscle tissues retained the lowest amount of selenium-75, the amount of selenium-75 taken by human body will be relatively lower by the use of this fish in feeding.

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Biokinetics of Selenium in the Benthic Shrimp Palaemon elegans *

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ABSTRACT

Organic compounds, probably low molecular weight peptides containing seleno-amino-acids, account for the most of the selenium dissolved in surface seawater. On the basis of this information, L-selenomethionine has been utilized for studying incorporation, body-distribution and elimination of selenium by the shrimp Palaemon elegans. Bioaccumulation of organic forms of selenium from seawater is much more pronounced than for inorganic forms such as selenite. More than 85% of the body burden of Se-75 was incorporated in high molecular weight proteins. Elimination of Se occurred following multiphasic kinetics, indicating the presence of at least three compartments, in which selenium shows different biological half-lives. The results obtained suggest the need of further studies on biomagnification and toxicity of organic selenium compounds to marine organisms.

INTRODUCTION

In consideration of their high toxicity of some selenium compounds experiments have been performed in order to elucidate the environmental behaviour of selenium and its transfer through terrestrial and aquatic food chains (1). Because of the relative low concentration factors (CF) (less than 50) encountered in experiments with marine organisms utilizing inorganic forms of Se-75 (2,3), in our experiments the kinetics of accumulation and loss of Se-75 have been studied in the benthic crustacean Palaemon elegans using seleno-methionine marked with Se-75. The seleno-aminoacid was chosen also because in marine surface waters selenium is predominantly present as organic compounds such as aminoacids and peptides of low molecular weight ((4). Therefore, it was appropriate to use seleno-L-methionine in our experiments in order to study accumulation, organ and tissue distribution as well as its release by the shrimp.

EXPERIMENTAL

The accumulation of 75-Se-L-methionine from water (370 kBq/10L) by the shrimp was followed for 25 days using two groups of 30 specimens each. During the experiment the concentration of 75-Se-methionine had to be corrected several times because of absorption to the container walls and excrements (5). After 25 days of accumulation no equilibrium was reached by the shrimp and accumulation continued linearily. At the end of the accumulation phase 10 individuals were dissected and the organ distribution determined.

RESULTS AND DISCUSSION

After 25 days, when the accumulation phase was interrupted, the concentration factor of the whole organism had reached a value of more than 400. Most of the radioactivity was found in the hepato-pancreas with a CF of about 4000 followed by gills (CF 1300) and stomach (CF 800).

The release of Se-75-methionine by the shrimp was observed for 59 days. At regular time intervals five specimens were dissected and the distribution of the radioactivity determined in the various organs and tissues. The release kinetic of selenium by the shrimp was characterized by three distinct phases: a fast phase, responsible for the elimination of about 30% of the body burden of Se-75 fixed in the hepato-pancreas and stomach, a medium phase which represents 52% of the total Se-75 and regards most of the remaining organs and a slow phase eliminating 18% of the total radioactivity localized in muscle tissues. The bilogical half-lives of 75-Se-methionine in the three compartments have been calculated to 2.3 days (digestive system), 15.4 days (remaining organs and tissues), and 138.6 days (muscle tissue).

About 90% of the 75-Se-methionine have been found in proteins (precipitation by Trichloroacetic acid) while the remainder was present as seleno-amino acids or peptides. Thus, one can assume that 75-Se-L-methionine is incorporated into proteins and substitutes the essential amino acid L-methionine.

During the experiments high mortalities could be observed in the shrimps which was attributed to the chemical toxicity of L-seleno-methionine, highly accumulated in some organs (digestive system) although the initial concentration in the water was extremely low (1nM).

These results require further studies for a better evaluation and understanding of the behaviour of organic compounds of selenium in the aquatic environment considering its bioavailability and transfer through the food chain as well as the determination of toxic levels for most sensitive species.

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